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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 09/998,284  
Filing Date: November 30, 2001  
Appellant(s): POULSEN ET AL.

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Harold H. Fox  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed July 21, 2008 appealing from the Office action mailed April 25, 2008.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

5770188                                      Hamade et al.                                      6-1998

Hamade et al. September 23, 1998; EP O 866103 A1.

Hansen et al. 1997; Hexose oxidase from the red alga *Chondrus crispus*. Journal of Biological chemistry 272 (17): 11581-11587.

James et al. 1997; Glucoamylases: Microbial sources, industrial applications, and molecular biology – A review. Journal of Food Biochemistry 21: 1-52.

### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 11-14, 34, 35, 40, 41, 42, 44, 45, 48, 49, and 50 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hamade et al. (September 23, 1998; EP O 866103 A1).

At page 3, lines 39-41, Hamade et al teach that the compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate OR *the compound having antimicrobial activity may be a compound formed from the product of such enzymatic reaction through further enzymatic reaction.*

At page 3, lines 51-53, the compound having antimicrobial activity includes hydrogen peroxide. At page 5, lines 14-16, Hamade et al. teach that the enzyme-substrate combination capable of producing hydrogen peroxide is not particularly restricted by preferable includes a combination such that the enzyme is an oxidase and the compound is oxidized by said oxidase. At page 5, line 18, the combination of oxidases and substrate include hexose oxidase-glucose. At line 57 on page 5, and at line 2 on page 6, the enzyme may be immobilized (re: Claim 11).

Therefore, to summarize these teachings of Hamade et al. as these teachings relate to instant Claim 1:

Enzyme1 + Substrate1 → Glucose (Substrate2) + Hexose Oxidase (Enzyme2) → Hydrogen Peroxide (Anti-fouling compound)

Hamade et al. teach to place the enzyme-substrate into a surface coating composition, comprising a film forming resin, an enzyme, and substrate, wherein the enzyme is capable of reacting with said substrate to produce a compound having antimicrobial activity. The film-forming resin includes acrylic resins, vinyl chloride resins, and the like (see page 6, lines 25-36).

At page 7, top, Hamade et al. teach to place the coating onto interior walls and floors of hospitals, schools, and hotels, and at line 15, placing the coating onto the bottom of ships, sea port facilities, buoys, pipelines, bridges, moorings, and so on to protect against fouling (line 18).

Therefore, It would have been obvious to a person having ordinary skill in the art to make an antifouling composition comprising a surface coating material (film forming resin or coating (**Claim 41**)), a first enzyme and first substrate to make a product

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(second substrate) which undergoes further enzymatic reaction to form the antimicrobial/antifouling compound, wherein the further enzymatic reaction is derived from an oxidase (second enzyme) to make hydrogen peroxide (antimicrobial/antifouling agent; **Claim 1, 11, 12, 13, 14, 48, 49**) because Hamade et al. teach that a compound having antimicrobial/anti-fouling activity may be a compound formed from the product of a first enzymatic reaction through a further second enzymatic reaction, and that the compound is hydrogen peroxide as a product of the reaction between hexose oxidase (**Claim 40, 44**) and glucose (**Claim 34, 35**), where in the surface coating material includes acrylic resins, vinyl chloride resin, and the like (**Claim 42**).

It would have been obvious to a person having ordinary skill in the art to place this anti-fouling composition onto the surface of a vessel because Hamade et al. teach that placing this composition onto the bottom of ships will protect the ships against fouling (**Claim 50**).

Claims 2, 3, 40, 43, 44, and 47 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hamade et al. (September 23, 1998; EP O 866103 A1) as applied to claim 1 above, and further in view of Hansen et al. (1997; Hexose oxidase from the red alga *Chondrus crispus*. Journal of Biological chemistry 272 (17): 11581-11587).

The teachings of Hamade et al. are set forth above. Hamade et al. teach to use the combination of the enzyme hexose oxidase and substrate glucose to make the antimicrobial/antifouling compound hydrogen peroxide. Hamade et al. do not teach the origin of the hexose oxidase.

Hansen et al. teach recombinant production of red alga *Chondrus crispus* hexose oxidase. Hansen et al. teach that this hexose oxidase catalyzes the oxidation of glucose. The amino acid sequence of this hexose oxidase is the same as that set forth in SEQ ID NO: 2.

It would have been obvious to one having ordinary skill in the art to include the hexose oxidase found in the red alga (**Claim 2, 47**) *Chondrus crispus* (**Claim 3**) having the amino acid sequence set forth in SEQ ID NO: 2 (**Claim 40, 43, 44**) taught by Hansen et al. in the composition comprising hexose oxidase taught by Hamade et al. because Hamade et al. teach to use the combination of hexose oxidase and glucose for the production of the antimicrobial/anti-fouling compound hydrogen peroxide and the hexose oxidase of Hansen et al. is a useful art-recognized equivalent in the catalytic conversion of glucose to hydrogen peroxide.

Claims 9, 10, 14, 45, and 46 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hamade et al. (September 23, 1998; EP O 866103 A1) as applied to claim 1 above, and further in view of James et al. (1997; Glucoamylases: Microbial sources, industrial applications, and molecular biology – A review. Journal of Food Biochemistry 21: 1-52).

The teachings of Hamade et al. are set forth above. Hamade et al. teach to use the combination of the enzyme hexose oxidase and substrate glucose to make the antimicrobial/antifouling compound hydrogen peroxide. Hamade et al teach that the compound having antimicrobial activity may be formed from the product of such

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enzymatic reaction through further enzymatic reaction. Hamade et al. do not specifically teach this "precursor enzymatic reaction" (Enzyme 1 and Substrate 1) that will produce the glucose that the hexose oxidase will catalyze to make hydrogen peroxide.

James et al. present a review article on glucoamylases, also known as amyloglucosidases (page 2, line 2). Amyloglucosidases use starch as a substrate for the production of glucose (see page 2+). James et al. discusses the industrial applicability of amyloglucosidases in the manufacture of food products (see page 17+).

It would have been obvious to a person having ordinary skill in the art to include amyloglucosidase (**Claim 9**) and starch (**Claim 10, 45, 46**) as taught in James et al. in the composition of Hamade et al. because Hamade et al. teach that the compound having antimicrobial/anti-fouling activity may be formed from the product of such enzymatic reaction through further enzymatic reaction of hexose oxidase and glucose, and James et al. teach that an enzymatic reaction producing glucose is the catalysis of starch by amyloglucosidase.

Therefore, to summarize the teachings of Hamade et al. and the teachings of James et al. as these teachings relate to instant Claim 1 and dependent claims 9, 10, 14, 45, and 46:

Amyloglucosidase (Enzyme1) + Starch (Subtrate1)→ Glucose (Substrate2)

Glucose (Substrate2)+ Hexose Oxidase (Enzyme2)→ Hydrogen Peroxide (Anti-fouling compound)

Claim 15 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the combined teachings of Hamade et al. (September 23, 1998; EP O 866103 A1) and



James et al. (1997; Glucoamylases: Microbial sources, industrial applications, and molecular biology – A review. Journal of Food Biochemistry 21: 1-52) as applied to claims 1 and 14 above, and further in view of Hamade et al. (June 23, 1998; USP 5,770,188).

The teachings of Hamade et al. (EP O 866103 A1) and James et al. are set forth above. The combined teachings of Hamade et al. and James et al. do not teach that the anti-fouling composition is self-polishable.

Hamade et al. (USP 5,770,188) teach that anti-fouling paint compositions comprising lipid encapsulated glucoamylase (amyloglucosidase) and starch are self-polishing (See col. 4, line 30-35; col. 6, line 31; Col. 7, lines 9-11). The advantages of composition comprising lipid coated enzyme include the retention of high activity in organic solvents, durability, and good stability in paint and paint films, and the retention of anti-fouling property over long periods of time without adversely affecting the environment (Col. 2, para. 5).

It would have been obvious to a person having ordinary skill in the art to encapsulate the amyloglucosidase in lipid in the anti-fouling composition rendered obvious by the teachings of Hamade et al. (EP O 866103 A1) and James et al. because Hamade et al. (USP 5,770,188) teach that the combination of encapsulated glucoamylase (amyloglucosidase) and starch render anti-fouling paint compositions self-polishing (**Claim 15**).

#### **(10) Response to Argument**

Claims 1, 11-14, 34, 35, 40, 41, 42, 44, 45, 48, 49, and 50 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hamade et al. (September 23, 1998; EP O 866103 A1).

Appellants' first argument is found at page 5 to page 6 paragraph 2 and at page 7, paragraph 1 of the Appeal Brief. Appellants allege that hindsight reconstruction of their invention was used to render obvious their claimed invention because Hamade discloses a one enzyme/one substrate coating composition.

The Examiner contends that all rejections are based on Hamade et al.'s statement at page 3, lines 39-41: the compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate OR *the compound having antimicrobial activity may be a compound formed from the product of such enzymatic reaction through further enzymatic reaction.*

In the first instance, Hamade et al. teach that the compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate. Thus, Hamade et al. teach the one enzyme/one substrate coating composition that will yield a compound having antimicrobial activity as insisted by Appellants. Diagrammatically, the teaching is as follows:

Enzyme1 + Substrate1 → Anti-microbial compound

In the second instance, Hamade et al. teach that *the compound having antimicrobial activity may be a compound formed from the product of such enzymatic reaction through further enzymatic reaction.* Thus, Hamade et al. teach that more than

one enzyme is present in the coating composition. Specifically, that the product of the interaction of one enzyme/one substrate can be further acted on by an enzyme to yield a compound having antimicrobial activity. Diagrammatically, the teaching is as follows:

Enzyme1 + Subtrate1 → Product + Enzyme2 → Anti-microbial compound

Thus, it is the second teaching of Hamade et al. to provide a coating composition comprising an enzyme and substrate that will result in a product/substrate and a second enzyme will act on the product/substrate to produce an antimicrobial/antifouling compound. **It is this teaching that is the basis of all rejections in this instant application.**

Appellants' second argument (page 6, para. 3) is that Hamade et al. provide a list of enzyme-substrate combinations to produce antimicrobial agents but Hamade et al. does not provide directions on how one skilled in the art would select one enzyme-substrate combination over another. The combinations are all well-known in the art to produce antimicrobial agents, which is why Hamade et al. simply lists them. There is no reason for Hamade et al. to teach what is well-known in the art of enzyme technology.

Claims 2, 3, 40, 43, 44, and 47 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hamade et al. (September 23, 1998; EP O 866103 A1) as applied to claim 1 above, and further in view of Hansen et al. (1997; Hexose oxidase from the red alga *Chondrus crispus*. Journal of Biological chemistry 272 (17): 11581-11587).

Appellants urge (page 7) that because the first rejection over Hamade et al. is in error, then this rejection is also in error. See the Examiner's response above.

Appellants urge that Hansen et al. teach hexose oxidase from *C. crispus* and do not reach or suggest anti-fouling compositions of Hamade et al. As noted above, it is the second instant teaching of Hamade et al. that renders the invention obvious as set forth in the rejection.

Claims 9, 10, 14, 45, and 46 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hamade et al. (September 23, 1998; EP O 866103 A1) as applied to claim 1 above, and further in view of James et al. (1997; Glucoamylases: Microbial sources, industrial applications, and molecular biology – A review. *Journal of Food Biochemistry* 21: 1-52).

Appellants urge (page 8) that because the first rejection over Hamade et al. is in error, then this rejection is also in error. See the Examiner's response above.

Appellants urge that James et al. is drawn to the use of glucoamylases in the food industry and is not germane to the instant technology. James et al. is a review article teaching equivalents of glycoamylases and their safe industrial use. Hamade et al. (June 23, 1998; USP 5,770,188) also teach the use of anti-fouling paint compositions comprising lipid encapsulated glucoamylase (amyloglucosidase).

Claim 15 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the combined teachings of Hamade et al. (September 23, 1998; EP O 866103 A1) and James et al. (1997; Glucoamylases: Microbial sources, industrial applications, and molecular biology – A review. Journal of Food Biochemistry 21: 1-52) as applied to claims 1 and 14 above, and further in view of Hamade et al. (June 23, 1998; USP 5,770,188).

Appellants urge (page 9) that because the rejection over Hamade et al. and James et al. is in error, then this rejection is also in error. See the Examiner's response above.

Appellants urge that Hamade et al. (June 23, 1998; USP 5,770,188) use a single lipid coated enzyme and therefore does not resolve the teachings of Hamade et al. and James et al. together. The references must be combined as set forth in the rejection and not argued separately. It is what the references teach together that renders the invention of Claim 15 obvious.

#### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,  
  
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